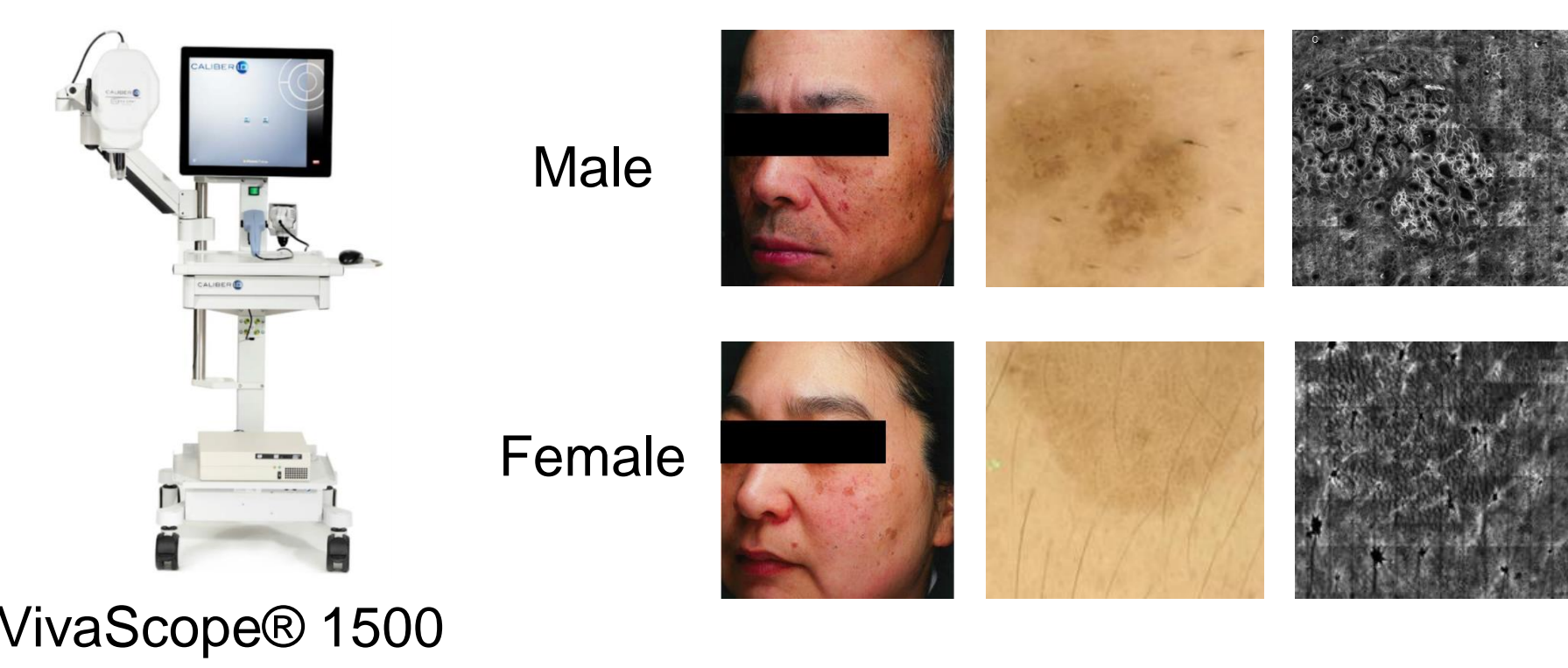


The Path to More Attractive Male Skin: Intricate Structure of Rete Pegs with Excessive Accumulation of Melanosomes Causes the Darkening of Male Spots

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Introduction:

Our previous study showed that male pigmented spots tend to be darker and more conspicuous than female pigmented spots and that the appearance of pigmented spots adversely affects females' first impressions of male attractiveness. Furthermore, we have found that plasmin activity was significantly increased in male pigmented spots compared with non-pigmented areas [1]. However, the cause of the darker coloration of male pigmented spots has not been fully elucidated. Consequently, the difference in the internal structure of the skin between male and female pigmented spots was investigated. The internal structure of the skin was observed by *in vivo* confocal laser scanning microscopy (CLSM).



VivaScope® 1500

Results & Discussion:

1. A significant increase in maximum thickness of the epidermis compared to the non-pigmented area indicates that the rete pegs extend toward the dermis in the area of pigmented spots (Table 1).
2. In male dark-colored pigmented spots, rete pegs extend vertically and horizontally and showed a complex, intricate shape (Figs. 3 and 4), and melanosomes content was significantly increased to about 8 times that of non-pigmented areas, and more than 4 times that of female pigmented spots (Fig. 5).
3. Although the number of epidermal basal cells was significantly increased in pigmented spots due to the expansion of rete pegs, no significant change in SC thickness was observed (Table 1).
4. We speculate that both melanogenesis of melanocytes and proliferation of stem cells via symmetric division [5, 6] were excessively promoted in male dark-colored pigmented spot sites.

Table 1. Skin internal structure parameters of pigmented spot sites

	SC Thickness (μm)	Epidermis		Basal Cells (HS)			Melanosomes		Dermal Papillae				
		Min (μm)	Max (μm)	Total Area (μm ²)	Mean Area (μm ²)	Mean Width (μm)	Content (x10 ⁶ μm ³)	Density (%)	Area (μm ²)	Circ.	AR	Round	Solidity
Male Dark Spots	21.17	85.62	135.8	8,366	250	10.5	1.217	4.45	1,132	0.602	1.731	0.637	0.871
Male Non-spot	21.06	70.90	101.2	5,822	188	10.4	0.150	1.15	539	0.747	1.585	0.669	0.942
		N.S.	p<0.01	p<0.01	p<0.01	N.S.	N.S.	p<0.01	p<0.05	p<0.05	N.S.	N.S.	p<0.05
Female Light Spots	21.35	84.16	141.2	4,966	185	11.4	0.473	2.42	844	0.715	1.552	0.696	0.934
Female Non-spot	21.79	71.49	113.0	6,190	234	13.2	0.121	1.02	807	0.743	1.499	0.701	0.941
		N.S.	N.S.	p<0.01	N.S.	N.S.	p<0.01	p<0.05	N.S.	N.S.	N.S.	N.S.	N.S.
Male Dark Spots	22.19	73.93	122.5	6,837	208	12.4	0.293	1.69	475	0.699	1.503	0.693	0.908
Male Non-spot	20.76	78.90	99.3	3,966	-	-	0.050	0.66	550	0.638	1.683	0.658	0.885
		N.S.	N.S.	p<0.01	p<0.05	-	p<0.05	p<0.05	N.S.	N.S.	N.S.	N.S.	N.S.
Female Light Spots	21.48	81.57	117.1	6,848	323	14.8	0.243	1.77	386	0.665	1.525	0.690	0.892
Female Non-spot	20.02	78.23	101.5	4,878	160	12.4	0.028	0.44	261	0.709	1.467	0.739	0.898
		N.S.	N.S.	p<0.05	p<0.05	N.S.	N.S.	p<0.05	N.S.	N.S.	N.S.	N.S.	p<0.05

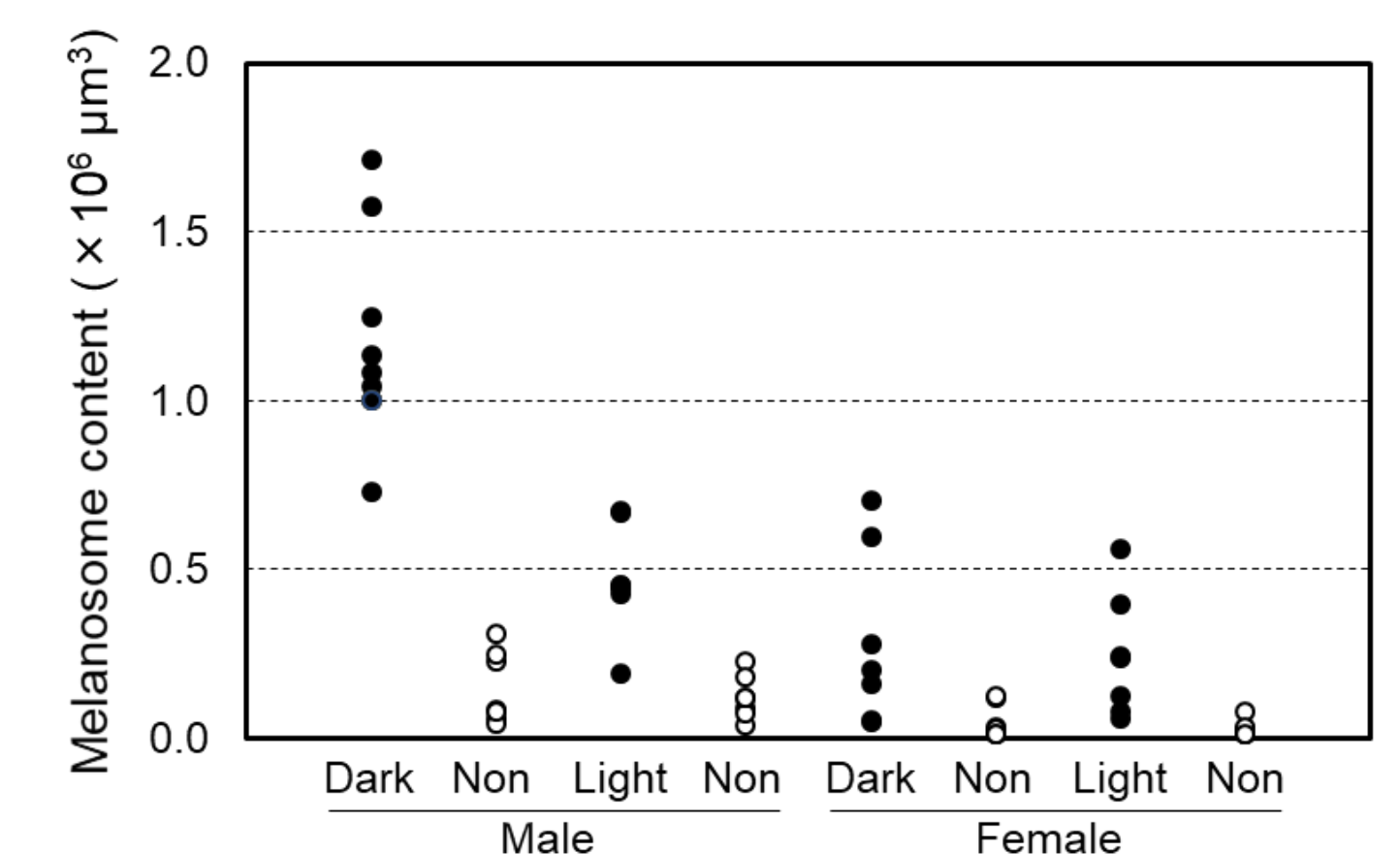


Fig. 5. Melanosome content of epidermal basal cells in pigmented spots and non-pigmented areas. Closed circles: pigmented spots; open circles: non-pigmented areas.

Materials & Methods:

1. Classification of pigmented spots by facial images

Subjects: Twenty healthy Japanese volunteers (9 men, 11 women) between 42 and 59 years old.

Lightness difference (ΔL^*): ΔL^* value between the pigmented spots and non-pigmented area was calculated from the mean L^* values of facial images captured using VISIA® (Canfield Scientific Inc.). The L^* value was calculated using XYZ values converted from the RGB values obtained from facial images via linear RGB values [2-4].

Dark-colored pigmented spots: ΔL^* value of 11 or higher

Light-colored pigmented spots: ΔL^* value of 7 or lower



Fig. 1. Example of skin color measurement of pigmented spots and surrounding non-pigmented area.

2. CLSM imaging and image analysis

Subjects: Thirteen subjects (6 men, 7 women) between 42 and 59 years old, selected from the above 20 subjects based on color of pigmented spots.

CLSM imaging: CLSM was performed using a VivaScope® 1500 (Caliber I.D.).

Parameters: Parameters of the epidermal structure measured by image analysis based on CLSM image are shown in Fig. 2.

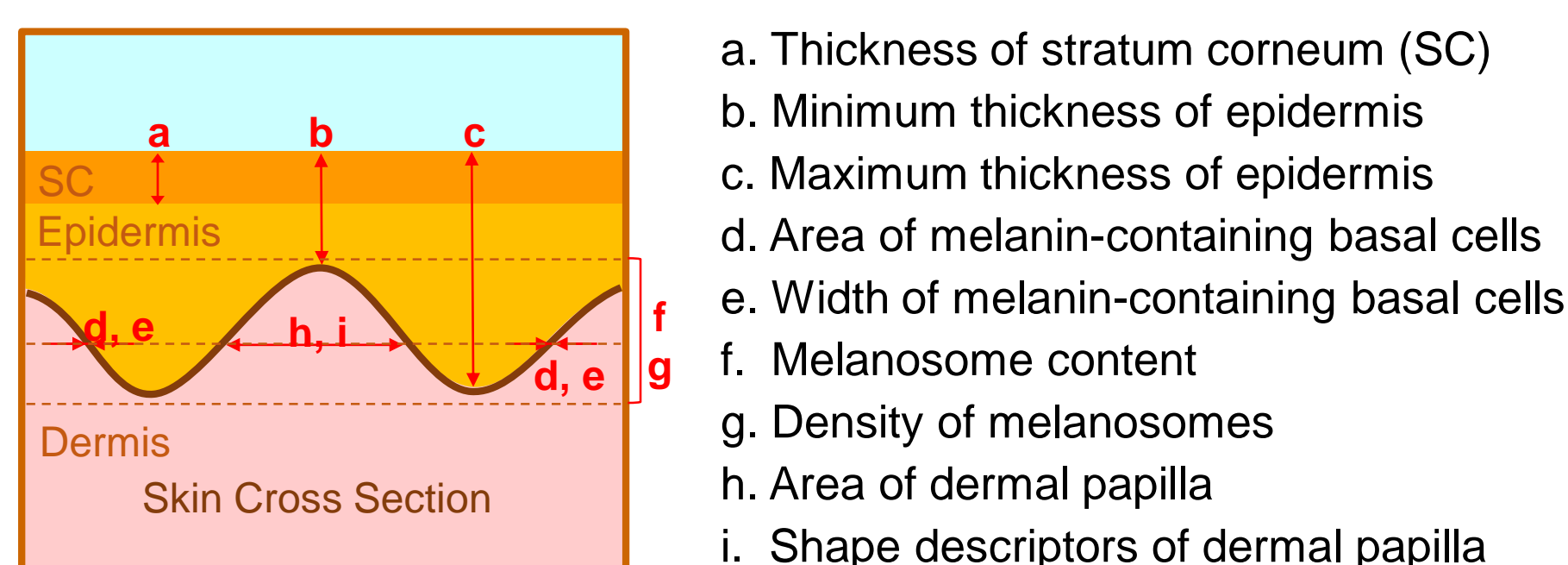


Fig. 2. Parameters of internal structure of the skin.

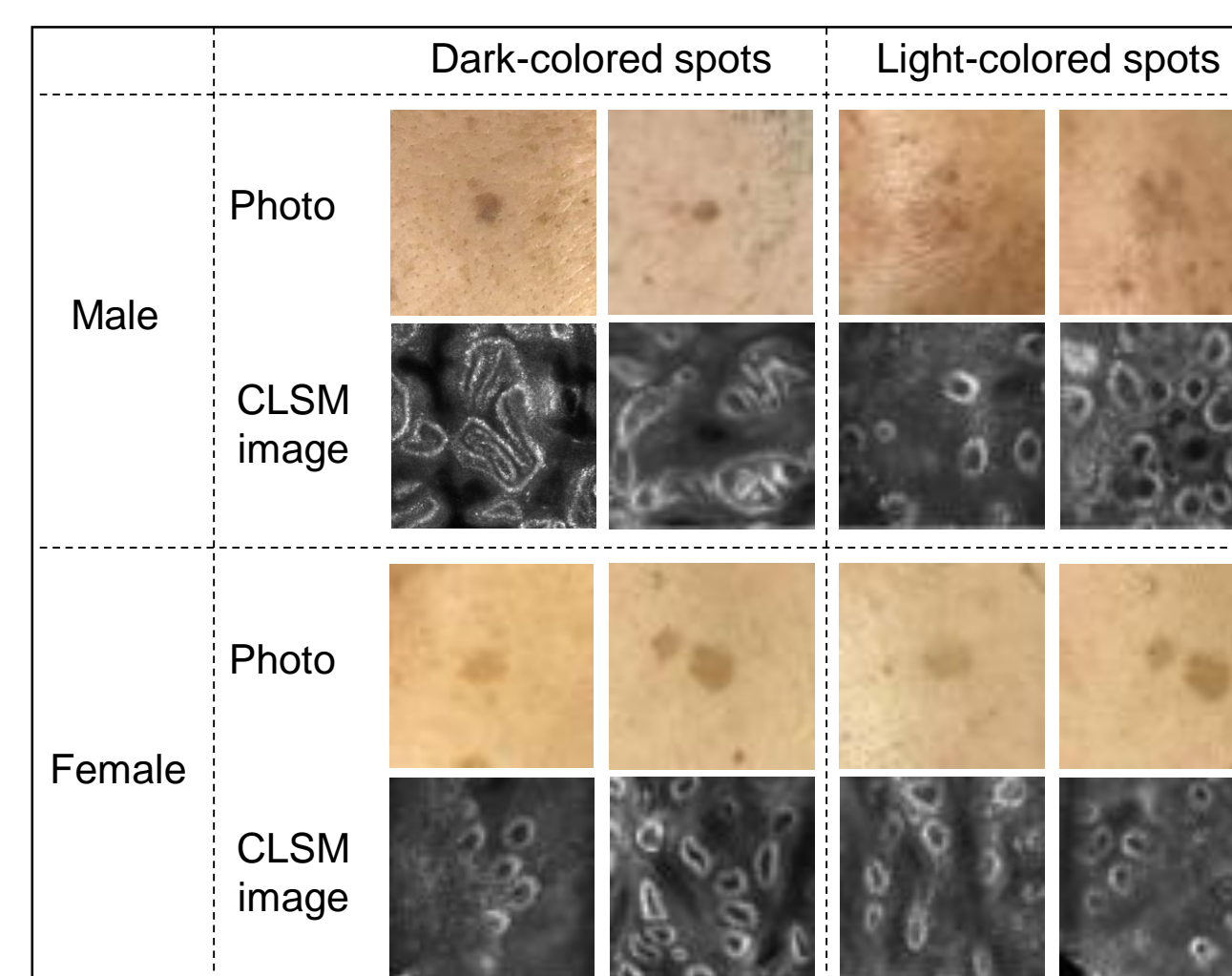


Fig. 3. Photographs of pigmented spots show a range of about 3 cm x 3 cm. Horizontal sections of CLSM images inside pigmented spot sites show a horizontal section in the range of 500 μm x 500 μm with a depth of about 90-110 μm from the surface.

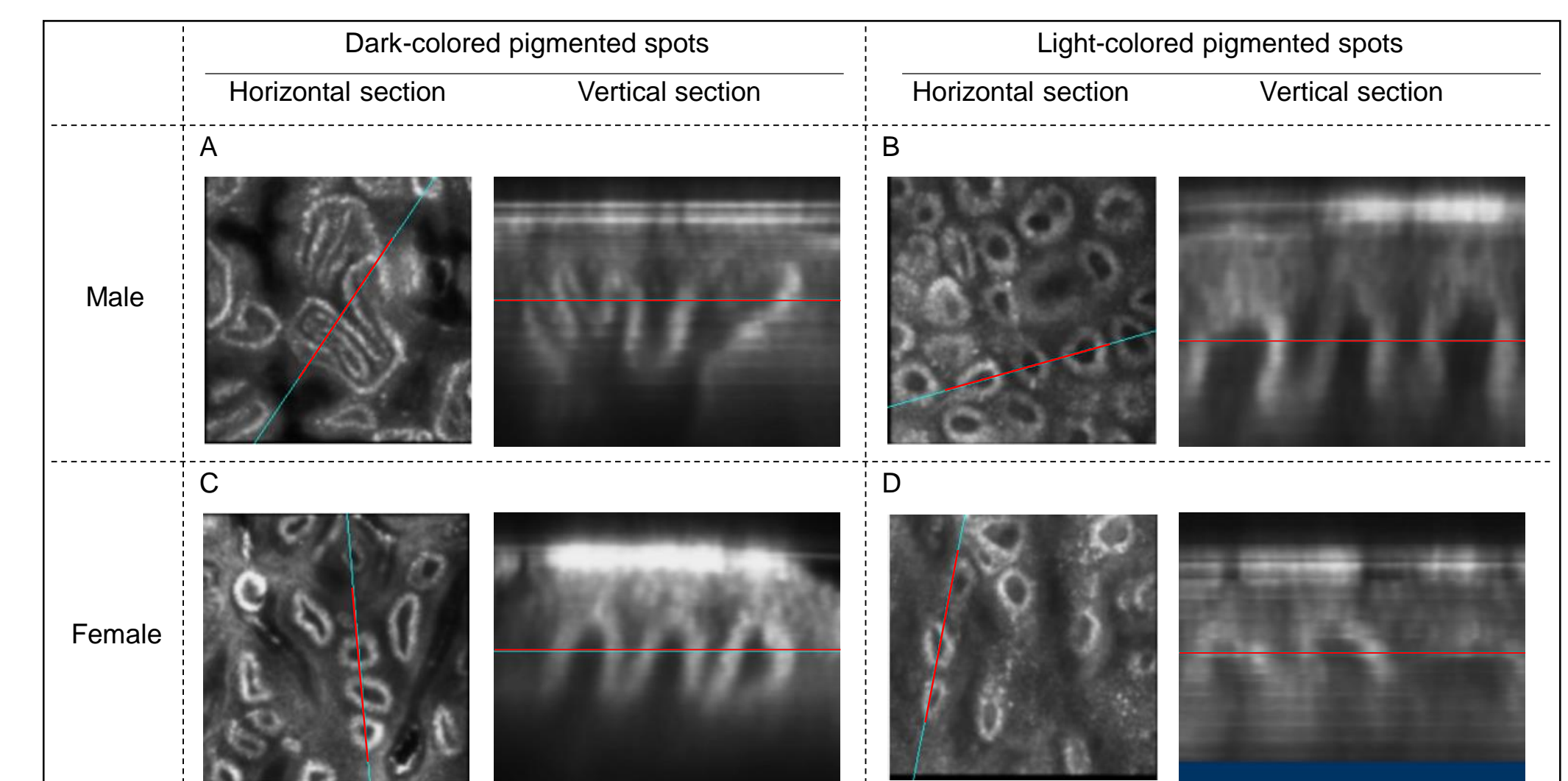


Fig. 4. Horizontal and vertical sections of CLSM images in male dark-colored pigmented spots [A], male light-colored pigmented spots [B], female dark-colored pigmented spots [C], and female light-colored pigmented spots [D].

Conclusions:

1. In female and male light-colored pigmented spots, the rete pegs extend to the dermis side more deeply, with a regular shape compared to non-pigmented areas.
2. In male dark-colored pigmented spots, the rete pegs were intricately intertwined by spreading and melanosomes accumulate in epidermal basal cells without decomposition.
3. The cause of the darkening of male pigmented spots could be hypothesized to accumulate undegraded melanosomes in the excessively proliferating epidermal basal cells.
4. Suppressing the synthesis of melanin and the proliferation of epidermal basal cells is useful in preventing and improving male dark-colored pigmented spots.

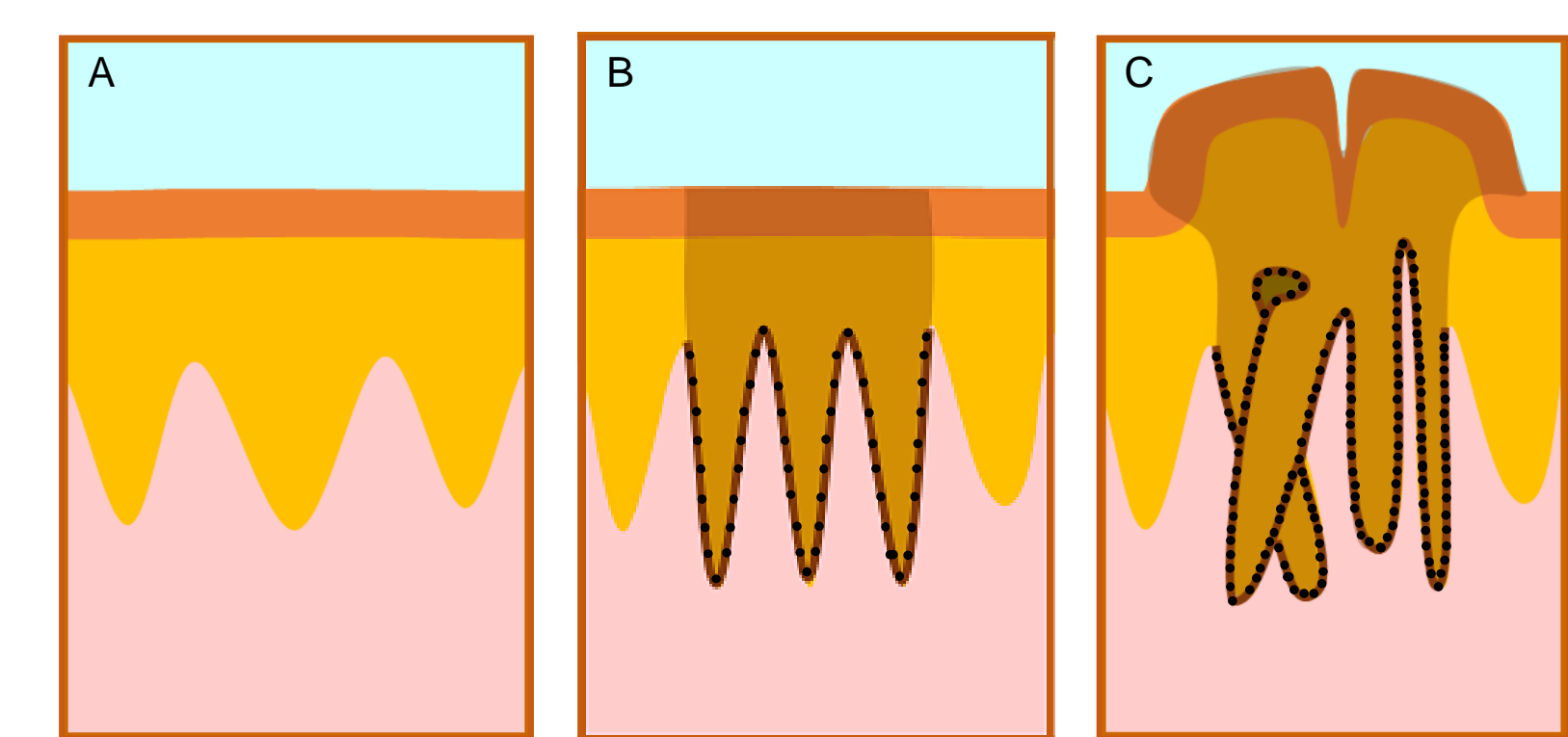


Fig. 6. Images of epidermal structure during the process of pigmentation, in non-pigmented sites [A], female pigmented spots and male light-colored pigmented spots [B], and male dark-colored pigmented spots [C]. The slight surface swelling seen in male dark-colored pigmented spots may be caused by an excessive increase in epidermal basal cells.

Aknowledgments:

We wish to express our deep appreciation to Professor and Chairman Daisuke Tsuruta and Associate Professor Toshiyuki Ozawa, Department of Dermatology, Osaka City University Graduate School of Medicine, for their guidance on the diagnosis of pigmented lesions and for their valuable advice and fruitful discussions throughout this study.

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